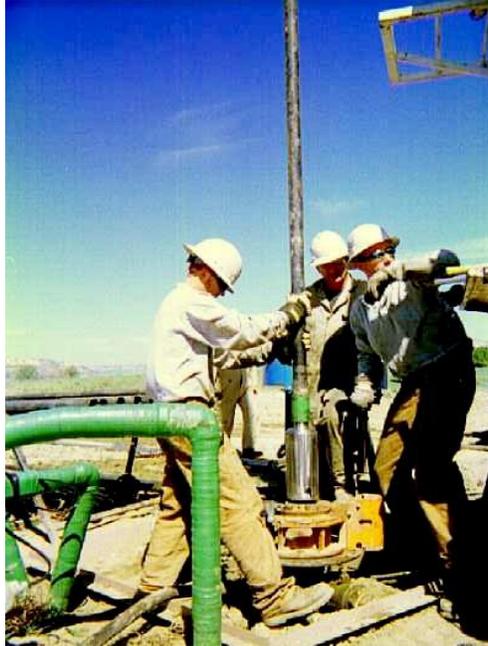




VortexFlow
DX (Downhole) Tool Installation Instructions

www.vortextools.com



The VortexFLOW tools are based upon Technology that is a result of U.S.A. patents 6,151,751; 6,659,118; 6,749,374; 7,066,207; 7,082,955; and 7,160,024 as well as additional patents pending.

The VortexFLOW DX series of downhole tools allow a well to:

- Lift more liquid with a given volume of gas
- Enable the well to recover frac fluid after initial completion more effectively
- Reduce bottom hole pressure
- Lift liquid with only 75% of the calculated critical gas rate
- Extend a well's flowing lifespan
- Even replace other mechanical forms of artificial lift, in some cases

The DX series of tools comes in five models:

- 1) DX – side port entry tool that is threaded to the bottom of a tubing string
- 2) DXI – bottom entry tool that is threaded to the bottom of a tubing string
- 3) DXR – retrievable tool that is inserted via slickline/wireline into the tubing and set in a profile nipple or a collar stop.
- 4) DXPL – retrievable tool that is inserted via a slickline/wireline into the tubing, takes the place of a plunger lift bumper spring assembly and aids in after-flow and plunger lifting a well.
- 5) DXB – retrievable tool that is attached (screwed or welded) to the end of coiled tubing/velocity string

Installation of the DX Downhole tool:

- Use established company procedures to determine if the tubing will be:
 - Snubbed in,
 - Run after the well is killed, or
 - Run live

- The Vortex Downhole DX tool is threaded in a tubing collar on the bottom of the tubing string
 - If possible, the DX tool should be held near the center of the casing with centralizers.
 - At least one joint of straight pipe and/or a centralizer should be installed above the DX tool before any profile nipples are installed.
 - A properly functioning DX tool will maintain the liquid level near the bottom of the tubing. Production engineers should determine where the tool should be set in the well to maintain the liquid level at the proper height and maximize gas production. Vortex*FLOW* engineers are able to assist in this process (if requested).



Installation of the DXI Downhole Bottom Entry Tool:

- Use established company procedures to determine if the tubing will be:
 - Snubbed in,
 - Run after the well is killed, or
 - Run live
- The Vortex Downhole DXI tool is threaded in a tubing collar on the bottom of the tubing string.
 - If the DXI tool is being installed on an existing well, the tool should not be set into a packer since setting a tool into the packer will not enable the gas volume in the annulus to be available to clear the water from the tubing after installation.
 - If possible, one joint of straight pipe and/or a centralizer should be installed above the DXI tool before any profile nipples are encountered by the vortex flow regime.
 - A properly functioning DXI tool will maintain the liquid level near the bottom of the tubing. Production engineers should determine where the tool should be set in the well to maintain the liquid level at the proper height. Vortex*FLOW* engineers are able to assist in this process (if requested).



Installation of the DXR Downhole Retrievable Tool:

- Use established company procedures to determine if the tubing will be:
 - Snubbed in,
 - Run after the well is killed, or
 - Run live

- The Vortex Downhole DXR tool is inserted in the tubing string via a slickline or wireline job.
 - A gauge ring or broach equal to the recommended API drift diameter should be run down the tubing string prior to running the DXR tool to ensure that the tubing string is clear and to verify the seating nipple depth.
 - The DXR tool can be set in a profile nipple or collar stop.
 - If the well is a higher total liquid producer, the seating nipple assembly is recommended.
 - If a seating nipple was not previously installed, then the collar stop assembly should be considered for setting the tool versus working over the well to pull tubing and run the profile nipple.
 - A properly functioning DXR tool will maintain the liquid level near the bottom of the tubing. Production engineers should determine where the tool should be set in the well to maintain the liquid level at the proper height. Vortex*FLOW* engineers are able to assist in this process (if requested).



Installation of the DXPL Downhole Retrievable Tool:

- Use established company procedures to determine if the tubing will be:
 - Used as is or replaced before installing the plunger lift downhole equipment
 - If used as is, a seating nipple assembly to allow the bumper spring assemble to be installed needs to be at the proper depth at the end of tubing

- If tubing is to be pulled and/or run then use established company procedures to
 - Snub in,
 - Run after the well is killed, or
 - Run live

- The lubricator assembly shall be installed using established company procedures prior to installing the DXPL assembly.

- The Vortex Downhole DXPL tool is inserted in the tubing string via a slickline or wireline job or is could be dropped down the tubing, but this is not recommended.
 - A gauge ring or broach equal to the recommended API drift diameter should be run down the tubing string prior to running the DXPL tool to ensure that the tubing string is clear and verify seating nipple assembly depth.
 - The DXPL tool, since it is a combination Vortex flow tool and plunger lift bumper spring assembly can be set in profile nipple/downhole assembly for the plunger bumper spring.
 - A properly functioning DXPL tool will maintain the liquid level near the bottom of the tubing. Production engineers should determine where the tool should be set in the well to maintain the liquid level at the proper height. Vortex*FLOW* engineers are able to assist in this process (if requested).



Installation of the DXB Downhole Retrievable Tool:

- Use established company procedures to rig up, kill the well, pull existing production tubing, and install the bull nose tool on coiled tubing/velocity string.
- An aluminum end cap is available to be placed on the end on the DXB tool to cover the inlet ports and allow the tool and coiled tubing/velocity string to be run using a lubricator without the need to temporarily kill the well. This cap is removal downhole with approximately 20 p.s.i. of differential pressure.
- The Vortex Downhole DXB (bull nose) tool is inserted in the well casing or existing production tubing
 - A gauge ring or broach equal to the recommended API drift diameter should be run down the well prior to running the DXB tool to ensure that the well casing or existing is clear.
 - A properly functioning DXB tool will maintain the liquid level near the bottom of the tool at the end of the coiled tubing/velocity string. Production engineers should determine where the tool should be set in the well to maintain the liquid level at the proper height. Vortex*FLOW* engineers are able to assist in this process (if requested).



Starting the Well Flowing after Installation:

After tool installation, it is recommended that the well be shut in for approximately 24 hours to allow bottomhole pressure to build. The well should then have production valves opened to see if it will return to flowing.

If the well fails to start flowing naturally after installation, some combinations of the following actions have proven effective in the past:

- Build up casing pressure for a period of time (a few hours to a couple of days), then surge the well
- Soap injection
- Surface venting
- Swabbing

Operating Your Well after a Vortex DX Series Tool Installation:

Be on the lookout for line pressure spikes. If this occurs, the critical gas rate may not be maintained. As a result, liquid may be held up in the tubing. An indication of this liquid hold-up is an increase in the casing pressure, an increase in liquid production and/or a decrease in gas production.

If liquid is held-up in the tubing it will need to be removed. Alternatives for removing this liquid include:

- Shutting in the well to build up pressure
- Venting the well to atmosphere for a short period of time until liquid production rate declines
- Applying soap down the casing
- Dropping soap sticks down the tubing

It is also possible to use a combination of the above methods in conjunction with a DX tool as a longer-term production method.

For example, a DX tool may enable the well to flow down to 75% of critical gas rate. Then with a DX tool and soap injected occasionally down the casing, the well may continue to flow 24 hours a day, down to approximately 50% of the critical gas rate.

If a well is being intermitted, you may choose to continue to intermit your well with a DX tool. With a DX tool in place, you will see more water produced from the reservoir and increased gas production from each cycle.

Operating factors to track prior to and after DX series tool installation:

- Gas rate
- Liquid rate (produced water, oil and/or condensate)
- Tubing and casing pressure
- Line pressure and temperature
- Fluid level

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